

TYPHOON ALEX (08W)

Typhoon Alex was the fourth and final tropical cyclone to develop during the month of July, and combined with Typhoon Wynne (07W) to form the first multiple-storm situation of the 1987 western North Pacific tropical cyclone season. Wynne (07W) passed through the Marshall Islands and intensified to tropical

storm intensity as Alex showed initial signs of development on July 22nd. Six days later, on the 28th, Wynne (07W) began to slowly recurve south of Japan as Alex dissipated over the eastern China coast. The closest the two systems came to one another was 740 nm (1370 km) late on the 28th.

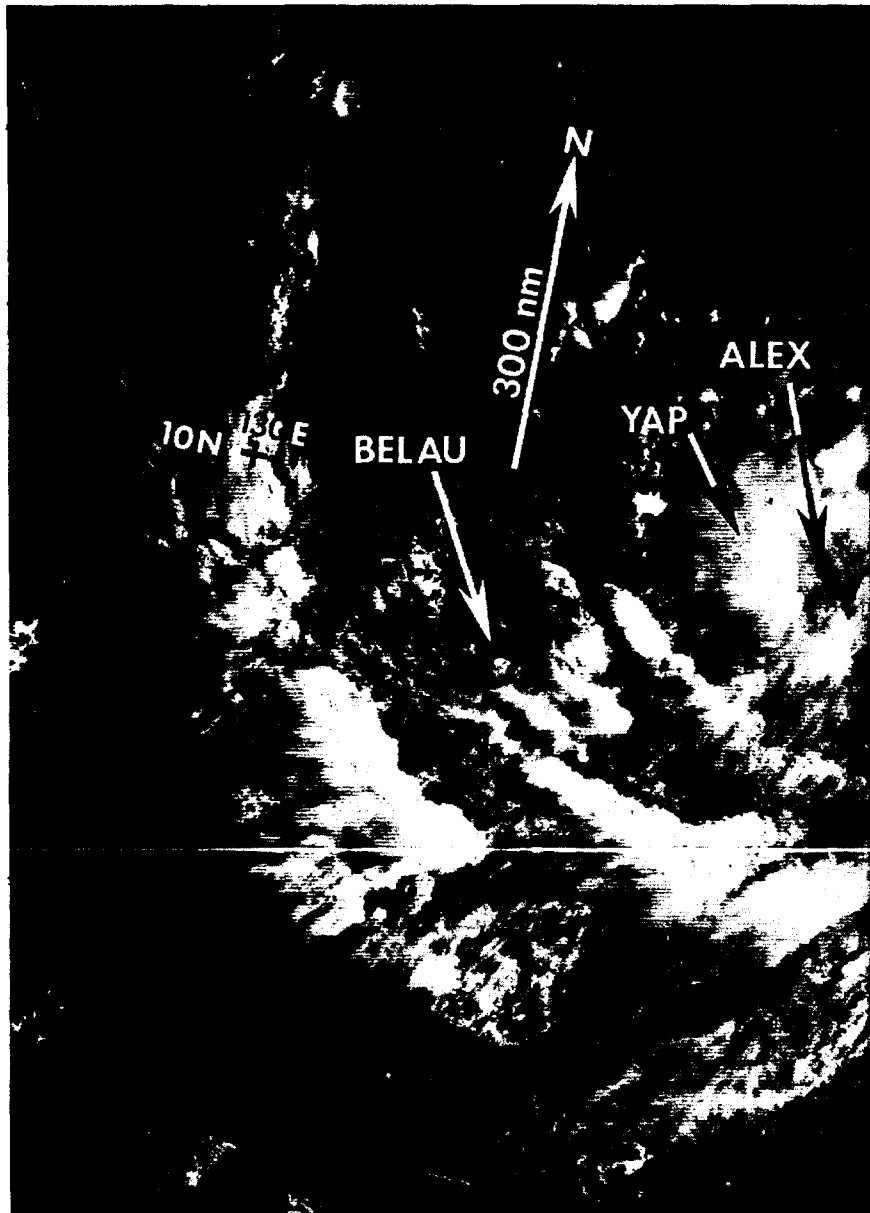


Figure 3-08-1. Morning view of the tropical disturbance in the Philippine Sea which would develop into Typhoon Alex. Convective banding is evident in the low-level cloud lines (220102Z July DMSP visual imagery).

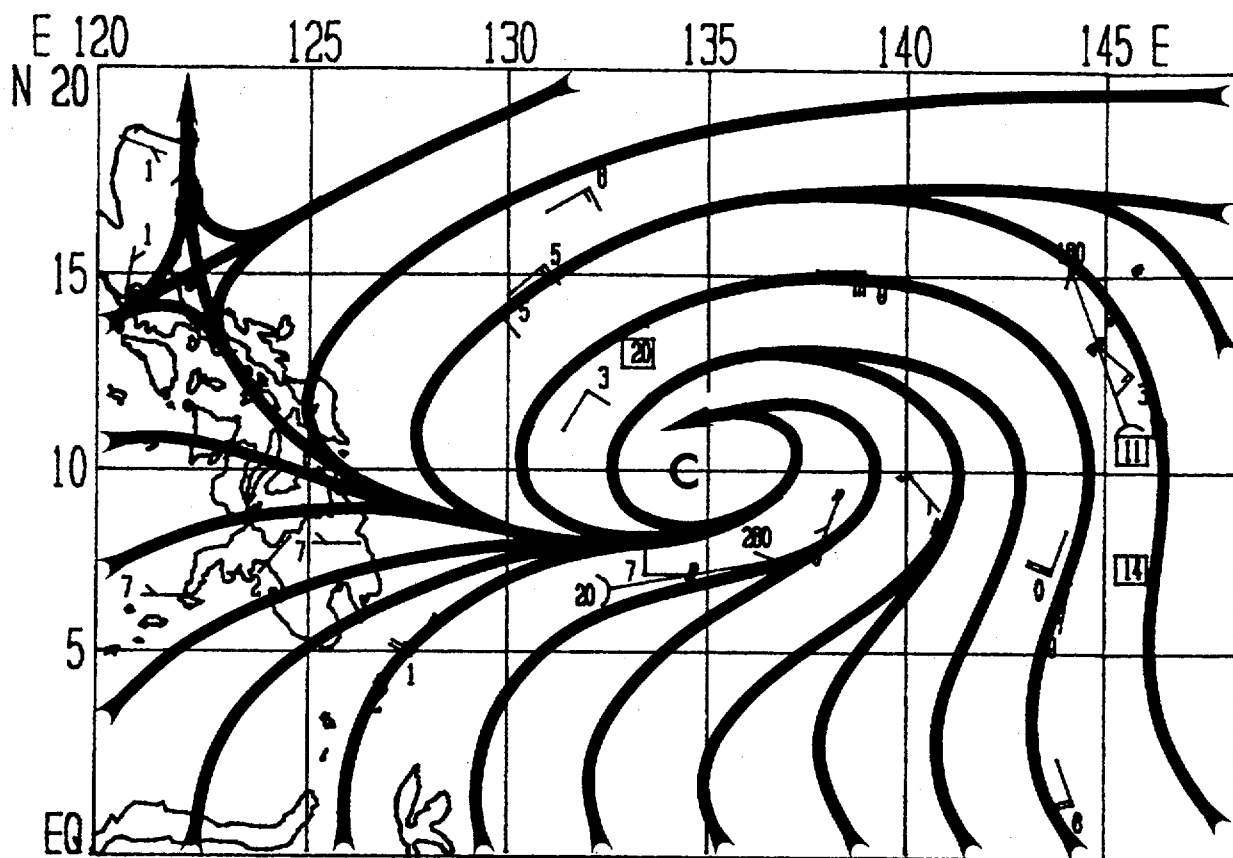


Figure 3-08-2. Synoptic surface/gradient-level streamline analysis of 230000Z July data shows a broad cyclonic circulation in the Philippine Sea with an estimated minimum sea-level pressure of 1000 mb and winds of 30 kt (15 m/sec). (Note: drifting buoy wind speeds (in kt) enclosed in boxes.)

Alex developed in the western end of an active monsoon trough which stretched east-to-west 2400 nm (4445 km) (south of 10 degrees North Latitude) from the dateline across the Marshall and Caroline Islands. Late on the 21st, routine analysis of satellite imagery indicated a tropical disturbance persisting in an area of poorly organized convection 200 nm (370 km) to the southwest of Guam. This area was noted on the Significant Tropical Weather Advisory (ABPW PGTW) at 220600Z due to its persistence and indications of convective banding in the low-level cloud lines visible on visual imagery that morning (Figure 3-08-1).

Over the next twelve hours, the convection increased and upper-level organization improved rapidly. Infrared satellite imagery at 221800Z indicated a central core of heavy convection had developed. Surface winds were estimated at 25 kt (13 m/sec) based on the Enhanced Infrared (EIR) technique (Dvorak, 1984). As a result, JTWC promptly issued a Tropical Cyclone Formation Alert (TCFA) at 221930Z even though synoptic data indicated only a broad surface circulation with an estimated minimum sea-level pressure of 1005 mb.

Satellite intensity analysis at 230000Z estimated surface winds of 35 kt (18 m/sec) associated with this disturbance. A 30 kt (15 m/sec) ship observation north of the disturbance for this same time provided some ground truth to the Dvorak estimate (see Figures 3-08-2 and 3-08-3). Based on these data, JTWC immediately issued the first warning on Tropical

Depression 08W. Six hours later, on the second warning, Alex was upgraded to tropical storm intensity based on increased organization that became evident on satellite imagery at 230600Z. Within 12-hours a well-defined convective band could be seen on satellite imagery wrapping into the center.

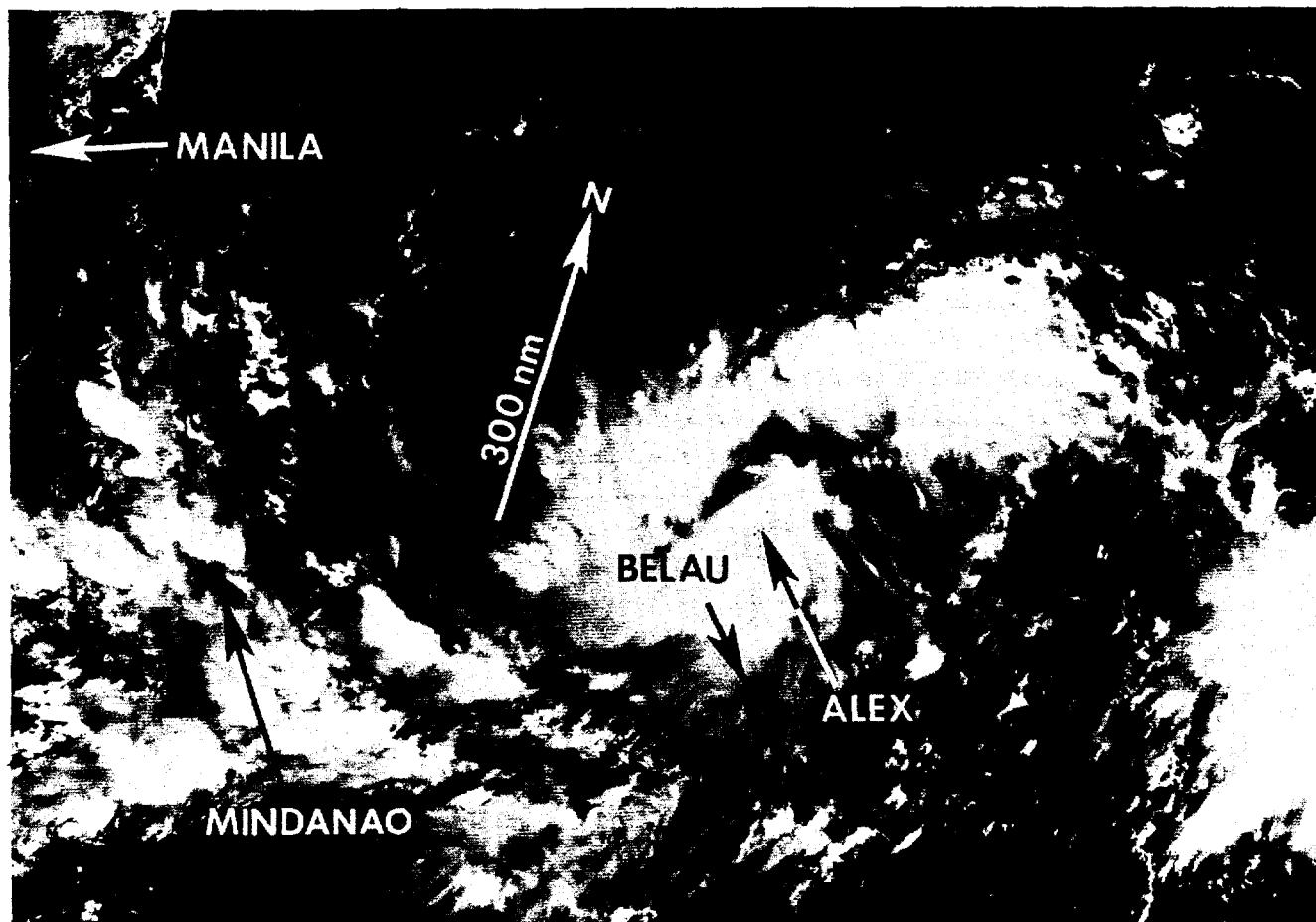


Figure 3-08-3. Visual satellite imagery near the time of the first warning on Tropical Depression 08W. See the 230000Z July synoptic surface/gradient-level streamline analysis in Figure 3-08-2 for comparison (230041Z July DMSP visual imagery).

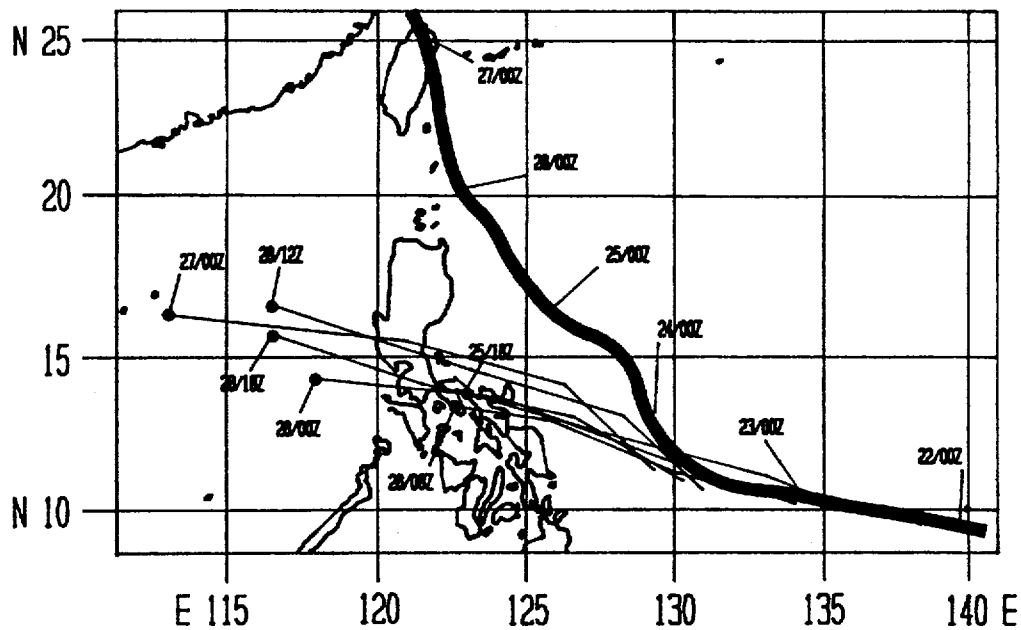


Figure 3-08-4. Initial OTCM 72-hour guidance for Alex indicated the system would remain south of the subtropical ridge and move across the Philippine Islands. Alex's best track is also shown for comparison.

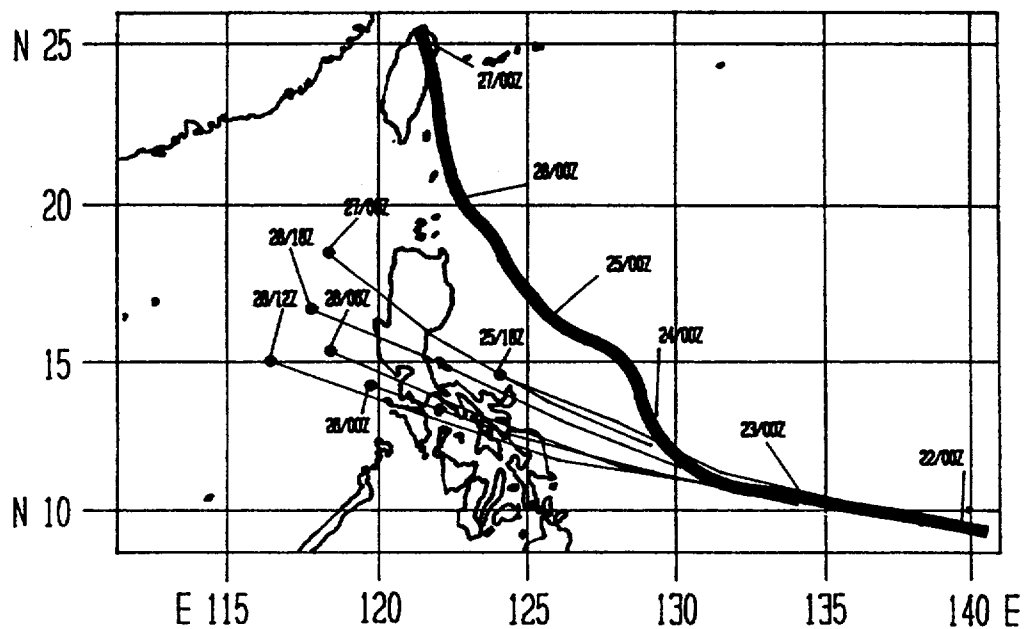


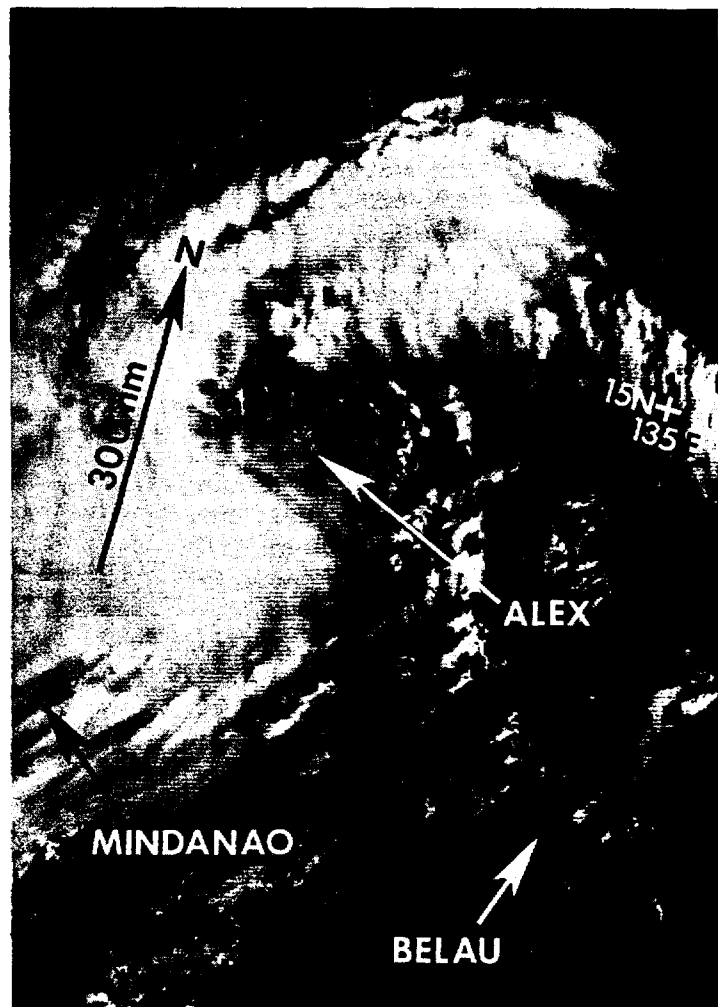
Figure 3-08-5. Initial HPAC 72-hour guidance for Alex agreed with the OTCM in keeping the system south of the subtropical ridge and moving it across the Philippine Islands. Alex's best track is also shown for comparison.

The main forecast problem occurred early, during the first two days of the system's lifetime. Alex was forecast to track across the Philippine Islands on warnings one through five. The primary guidance came from two forecast aids -- the One-Way Interactive Tropical Cyclone Model (OTCM) and the Half Climatology and Persistence Model (HPAC). Figures 3-08-4 and 3-08-5 show the guidance received for the first six warnings from the OTCM and HPAC, respectively. They incorrectly suggested Alex would remain south of the strong subtropical ridge, move across the Philippine Islands and then turn northward towards mainland China. JTWC forecasters determined the OTCM and HPAC guidance was flawed and, on the sixth warning, relocated Alex further north after several satellite fixes indicated it was moving towards the northwest rather than the west-northwest. Unfortunately, beginning at 240900Z, there was increased

scatter in the satellite fixes as a cirrus canopy developed over the center. This left JTWC forecasters with no clear-cut indication of exactly where Alex's low-level center was. A solitary aircraft radar fix was obtained at 240916Z which provided some close in information, however a trained Aerial Weather Reconnaissance Officer was not onboard the flight and the meteorological accuracy of the position was suspect. Figure 3-08-6 shows a satellite image prior to the time of the aircraft fix. Notice the exposed low-level center is displaced slightly northeast of the heaviest convection. The radar site at Guiuan (WMO 98558) in the Philippine Islands fixed this area of heavy convection and added to the uncertainty as to where the actual location of Alex's center was.

Forecast guidance for the next five warnings indicated Alex should track through

Figure 3-08-6. Morning view of Alex. The exposed low-level center is displaced slightly northeast of the heaviest convection (240021Z July NOAA visual imagery).



the Luzon Strait and make landfall over mainland China to the west of Taiwan. JTWC forecasts for this time period (240600Z through 250600Z) reflected this guidance. Also during this period, Alex continued to slowly intensify. Between 241500Z and 241800Z, it developed an eye. This eye was first implied by a warm spot in the central cloud mass on the nighttime infrared imagery (see Figure 3-08-7).

At 1200Z on the 25th, Alex reached its maximum intensity of 65 kt (33 m/sec) and was upgraded to typhoon status. At that time, Alex was 120 nm (222 km) east of the northeast tip of Luzon. Forecast guidance at 251200Z changed significantly, suggesting a more northward movement, which would take Alex east of Taiwan vice through the Luzon Strait. The reason for this change in computer forecast guidance appears to be twofold. First, a surface frontal boundary stalled across the eastern coast of Asia, and second, a large break developed between the upper-level subtropical ridge south of Japan and the Siberian High.

Alex remained at minimal typhoon intensity for another 30-hours and then began to slowly weaken. It was then steered toward the north by the low-level southerly flow east of the stalled front, which caused it to brush the eastern portion of Taiwan (Figure 3-08-8) and pass within 30 nm (56 km) of the capital city of Taipei.

Shortly after passing Taipei, Alex was drawn slightly westward by the lee effect of its interaction with Taiwan's mountainous terrain. This caused Alex to make landfall on the China coast near the city of Wenzhou, 200 nm (370 km) south of Shanghai. The system then moved inland and dissipated as a significant tropical cyclone. Figure 3-08-9 shows Alex with respect to Wynne for this same time period. Near 281800Z, the remnants of Alex, with its residual vorticity and moisture, once again moved over water but did not regenerate into a significant tropical cyclone. It did, however, add to the band of precipitation that had stalled over Korea and, as a consequence, over 12 inches (300 mm) of rain fell within 24-hours. This deluge triggered major flooding, landslides and loss of life. In contrast, the damage to Taiwan and China was minor.

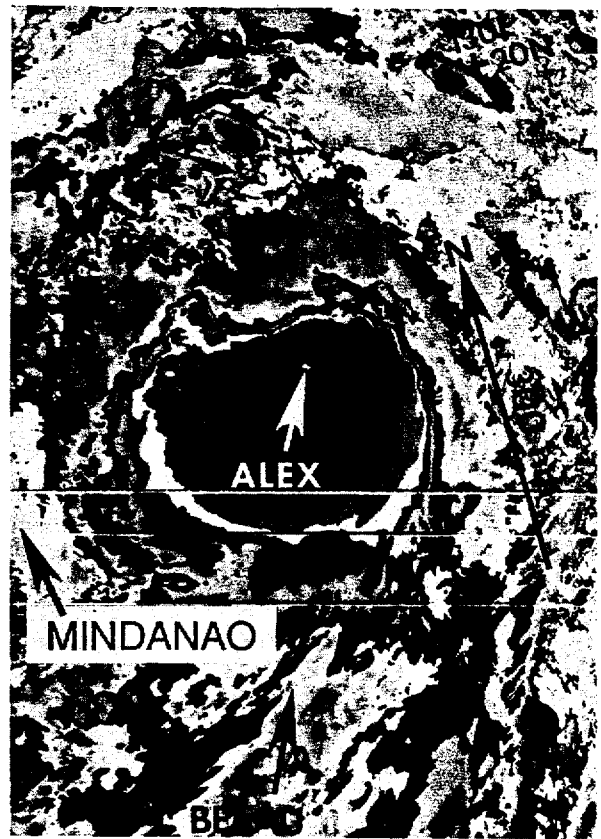


Figure 3-08-7. An implied eye appears as a warm (white) spot in the central cloud mass (dark gray) (241837Z July NOAA enhanced infrared imagery).

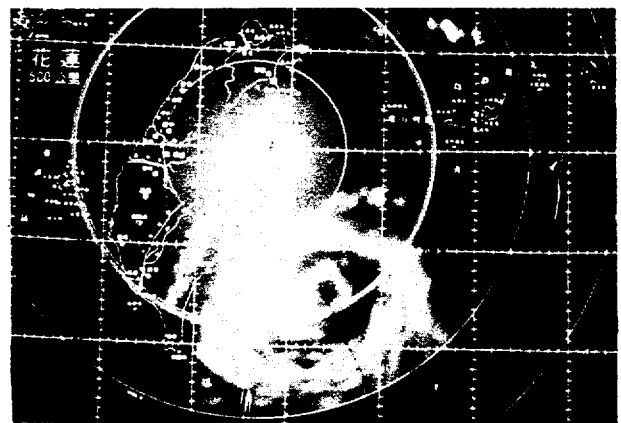


Figure 3-08-8. The tightly curved rainband and eye wall of Typhoon Alex as seen by radar from Hualien, Taiwan (WMO 46699) at 261400Z July (Photograph courtesy of Central Weather Bureau, Taipei,

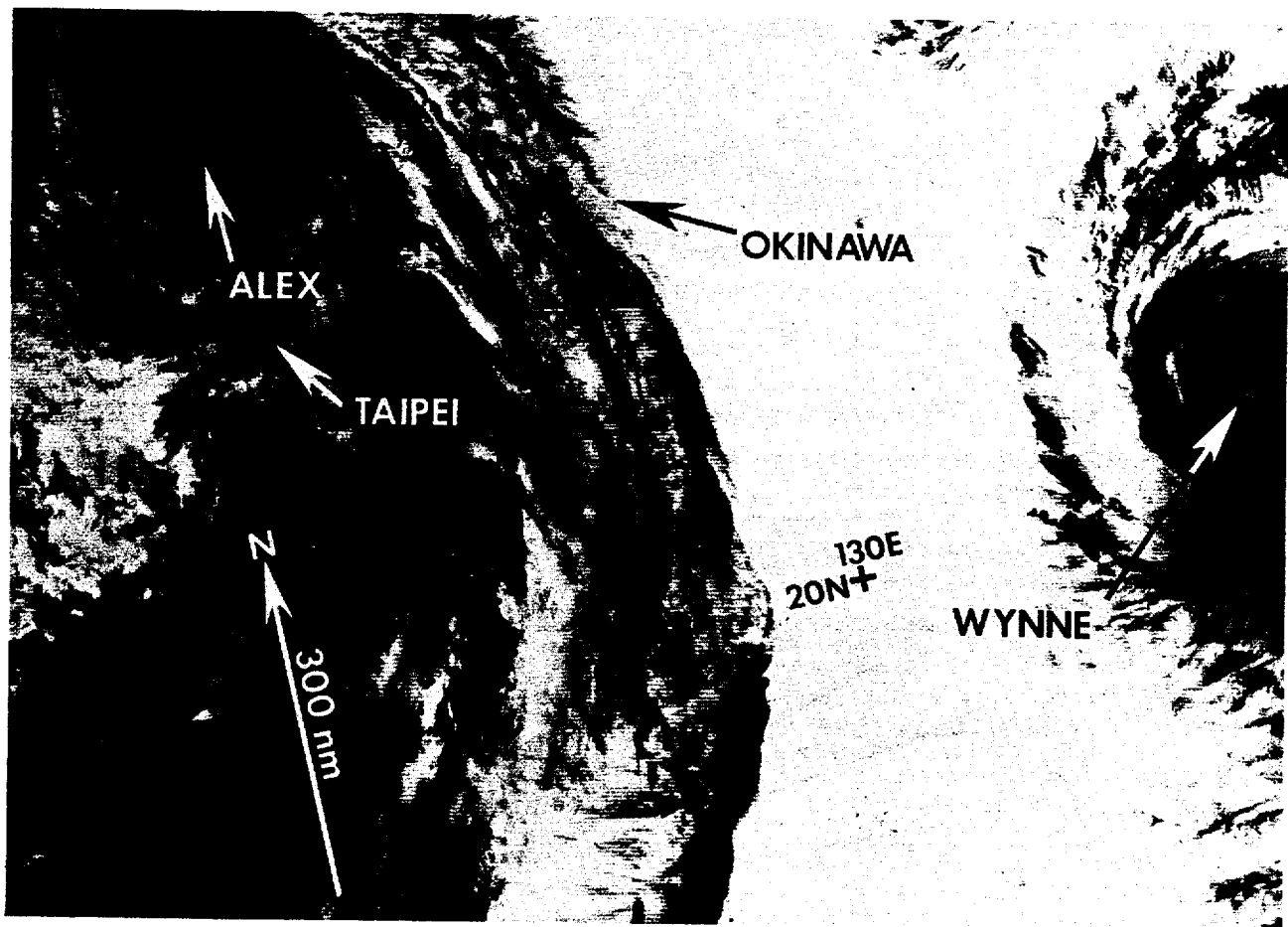


Figure 3-08-9. Typhoons Alex and Wynne (07W) appeared together on this thresholded infrared satellite image (Note: coldest cloud tops appear black). Alex had just moved inland over the eastern coast of China and Wynne was still on a northwestward track, heading toward Okinawa, Japan (271341Z July DMSP inverted infrared imagery).